THE EFFECTS OF TRADE DISTORTIONS: THE CASE OF THE SUGARCANE-ETHANOL INDUSTRY IN BRAZIL VERSUS THE CORN-ETHANOL INDUSTRY IN THE U.S.

Ariadna Martinez-Gonzalez, Ian Sheldon, and Stanley Thompson

Department of Agricultural, Environmental, and Development Economics

ABSTRACT: In order to compensate for the gap in price competitiveness derived from fossil fuel production still being more price-competitive than production of biofuels, the ethanol industry is heavily subsidized inside and protected from the outside in both the U.S. and Brazil. In this paper we assess the impact of the elimination of trade distortions, in particular, the 2.5 percent ad valorem tax, and a secondary tariff of 54 cents-per-gallon on imports from Brazil to the U.S., imposed to offset the 51 cents-per-gallon domestic subsidy to corn-ethanol production. For this purpose, we estimate a partial equilibrium trade model – an ethanol export supply curve for Brazil and an ethanol import demand curve for the U.S.-, based on annual data from 1975 to 2005. Two-stage least squares is used to estimate both curves, the world price of ethanol being treated as endogenous. The results show Brazilian export supply to be very sensitive to changes in prices, thus it is very likely that elimination of trade distortions in the ethanol market will result in a more than proportionate increase in ethanol exports from Brazil due to the rise in the world price. Moreover, according to this model, if the U.S. increases its demand for imports from Brazil, there will be a positive impact of the U.S. in driving the world price up. Therefore, this paper supports the idea that the U.S. and Brazil reap gains from trade when trade distortions are eliminated.

INTRODUCTION

Since the oil crisis of the 1970's, countries around the world, specifically those highly dependent on the movement of oil prices, have begun a quest for alternative sources of energy. Biofuels is one of the main sources; specifically ethanol and biodiesel dominate the market. Brazil took steps some thirty years ago to reduce its dependency on oil, by building the necessary infrastructure for becoming the leader in the sugar cane-based ethanol industry:

Country	2004 (mil. gal. per year)	2004 (percent)	Country	2005 (mil. gal. per year)	2005 (percent)
Brazil	3,969	37.9	Brazil	4,227	35.8
United States	1,600	15.3	United States	1,900	16.1
China	904	8.6	China	1,006	8.5
India	462	4.4	India	449	3.8
France	219	2.0	France	240	2.0
Russia	198	1.8	Russia	198	1.7
South Africa	110	1.0	Germany	114	1.0
United Kingdom	106	1.0	South Africa	101	0.9
Saudi Arabia	79	0.7	Spain	93	0.8
Spain	79	0.7	United Kingdom	92	0.8
Others	1,029	9.8	Others	1,386	11.8
Total	10,770	100.0	Total	11,790	100.0

The U.S. has decided to move towards reducing its oil dependence too:

- Government mandate requiring that ethanol be used instead of methyl-tert-butylether (MTBE) for blending in reformulated gasoline
- Energy Policy Act of 2005 requiring doubling the U.S.'s use of alternative fuels by 2012 to 7.5 billion gallons

Ethanol Industry (U.S.' and Brazil)

- Heavily subsidized inside
- Protected from the outside

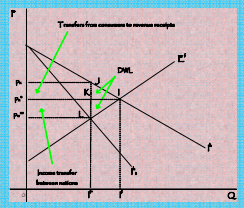
OBJECTIVE: assess the impact of the elimination of those trade distortions which prevent both the U.S. and Brazil reaping the gains from trade due to their comparative advantage.

•U.S. imports of ethanol from Brazil face high tariffs: a 2.5 percent ad valorem tax, and a secondary tariff of 54 cents-per-gallon, imposed to offset the 51 cents-per-gallon domestic subsidy to corn-ethanol production [Kopp, 2006].

METHODOLOGY

We estimate a partial equilibrium trade model:

- an ethanol export supply curve for Brazil
- an ethanol import demand curve for the U.S



Method: Two-stage least squares (the world price of ethanol being treated as endogenous)

$$(1) E_{Br,t} = \alpha_0 + \alpha_1 P_{eth,t} + \alpha_2 E_{Br,t-1} + \alpha_3 P_{oil,t} + \alpha_4 P_{sugBr,t} + \alpha_5 Pop_{Br,t} + \alpha_6 RGDP_{Br,t} + \varepsilon_t$$

$$(2) P_{eth,t} = \beta_0 + \beta_1 I_{US,t} + \beta_2 P_{oil,t} + \beta_3 Pop_{US,t} + \beta_4 RGDP_{US,t} + \upsilon_t$$

$$(3) E_{Br,t} = I_{US,t}$$

Based on annual data from 1975 to 2005

Sources: USDA's historical database, ERS-USDA database, FAO, Nebraska Ethanol Board, CEPEA and Unica.

$P_{eth,t}$ = world price of ethanol; $E_{Br,t}$ = Brazil's exports of ethanol; $P_{oil,t}$ = world price of oil; $P_{sugBr,t}$ = the price of sugar in Brazil; Pop = population in Brazil or U.S., respectively; RGDP = real gross domestic product in each country; and $I_{us,t}$ are U.S.' imports of ethanol.

RESULTS

$$(1)\quad E_{Br,t} = \underset{(-2.7211)}{-1083.59} + \underset{(2.6593)}{572.62}*P_{eth\_hat,t} + \underset{(2.0071)}{0.41}*E_{Br,t-1} - \underset{(-2.6519)}{12.13}*P_{oil} - \underset{(-2.3865)}{821.96}*P_{sugBr,t} - \underset{(-0.2183)}{0.41}*Pop_{Br,t} + \underset{(2.6689)}{1.77}*RGDP_{Br,t}$$

$$(2)\quad P_{eth,t} = \underset{(-3.4205)}{-6.43} + \underset{(1.8811)}{0.0028}*I_{USA,t} + \underset{(10.0563)}{0.026}*P_{oil,t} + \underset{(3.7099)}{0.037}*POP_{USA,t} - \underset{(-1.1949)}{8.98e\text{-}005}*RGDP_{USA,t} - \underset{(-5.6724)}{0.105}*trend +$$

$$[AR(1)=\underset{(-2.0098)}{-0.44}, AR(2)=\underset{(-1.6270)}{-0.37}, AR(3)=\underset{(-1.2150)}{-0.26}]$$

NOTE: t-statistics in parenthesis.

Price elasticity evaluated at the mean is 3.51 → Brazilian export supply is very sensitive to changes in prices → **the reduction in the tariff on Brazil's ethanol imports of 54 cents per gallon would cause an approximate increase of 1.35 percent in the total exports of Brazil.**

If the U.S. increases its demand for imports from Brazil, there will be a positive impact of the U.S. in driving the world price up (this is because the value of the flexibility of the world price of ethanol given an increase in U.S. imports of that product is 0.0028, which means that an increase in imports of ethanol from Brazil in 1 percent will increase world price by 0.08 percent).

MAIN FINDINGS FROM THE SIDE OF THE EXPORT SUPPLY CURVE:

(i) there is a positive relation between exports and the world price, this is in accordance with the trade model used in the analysis;

(ii) a negative effect on exports if the price of sugar rises, this might be caused because there is a substitution between sugar and ethanol production at the firms' plants so if they see a higher price of sugar they will shift to this product and reduce their production of ethanol available to export;

(iii) a positive effect of real GDP of Brazil, as the economy grows in real terms there is more potential for this economy to support profitable industries such as ethanol;

(iv) a negative effect of a rise in oil prices on the export supply, this is because there is a substitution effect in Brazil between oil and ethanol, i.e., the domestic demand for ethanol rises if the price of oil increases such that available production for exports is reduced in order to satisfy domestic needs; and

(v) the lag of exports is between 0 and 1 in absolute terms, meaning that the model is not explosive.

MAIN FINDINGS FROM THE SIDE OF THE IMPORT DEMAND CURVE:

(i) there is a positive relation between imports and the world price, which again is in accordance with the trade model;

(ii) a positive effect on the price of ethanol when the price of oil rises is totally in accordance with empirical evidence because in the U.S. the price of ethanol goes hand in hand with movements of the price of oil;

(iii) the lag of the price level is between 0 and 1 in absolute terms, meaning that the model is not explosive.

CONCLUSIONS/ DISCUSSIONS

This paper contributes to the discussion of whether or not the U.S. should reduce tariffs and taxes imposed on the imports of Brazilian sugar-cane ethanol.

In order to put these results in perspective three other papers in the literature can be mentioned: Elobeid and Tokgoz [2006], Gallagher et al. [2006], and Koizumi [2003]. In general, these papers conclude that **elimination of trade distortions will lead to an increase in the world price of ethanol**, which coincides with the results of this study though the size of the impact differs (this is particularly true for our analysis which finds a very small impact of an increase in imports on the price of ethanol).

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